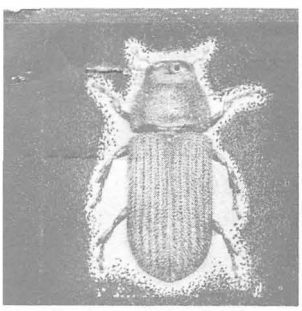
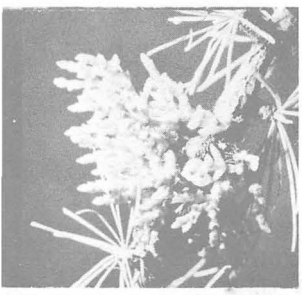
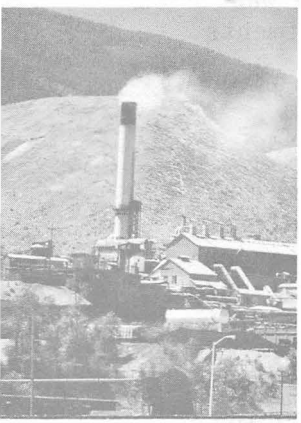
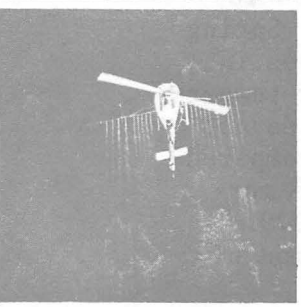
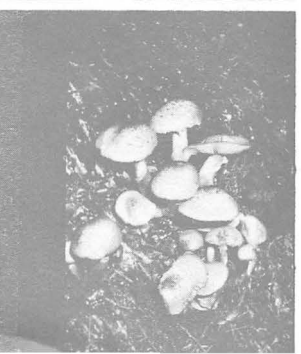








# FOREST INSECT & DISEASE MANAGEMENT

**USDA • FOREST SERVICE • NORTHERN REGION**

**State & Private Forestry • Missoula, MT 59801**

3450

Report No. 79-18 July 1979


## A REEVALUATION OF 1978 AERIAL BACILLUS THURINGIENSIS BERLINER (BT) APPLICATIONS FOR CANKERWORM CONTROL IN SIBERIAN ELM SHELTERBELTS


By

John Hard, Entomologist


### INTRODUCTION

Bacillus thuringiensis (Bt), in the form of Dipel TM®, was applied to cankerworm 1/ infested shelterbelts near Bismarck, North Dakota, in May 1978 (Hard, et al. 1979). Defoliation was significantly less on treated belts than on check belts when larvae had completed feeding, but there were no significant differences in defoliation among spray treatments. Most treated trees retained enough foliage to protect adjacent crops from wind, whereas untreated trees were often nearly stripped of leaves.

Cankerworm females are wingless and reinvasion of treated areas is accomplished by wind dispersal of young larvae. I reevaluated defoliation in 1979 on test shelterbelts to determine whether Bt treatment provided more than one season of foliage protection from cankerworms because many treated shelterbelts were located between untreated belts about 100 yards away.

### METHODS

I revisited test shelterbelts in late June 1979 after larval feeding was essentially completed to rate defoliation within approximately the same 1,000-foot midsection of each test

1/ Paleacrita vernata (Peck) and Alsophila pometaria (Harris).

shelterbelt rated in 1978. I made no attempt to rate the same trees used in 1978, but rated defoliation at 100-foot paced intervals on each side of each shelterbelt according to the following defoliation indices for each crown half:

1 = less than 25 percent defoliation
2 = more than 25 percent but less than 50 percent defoliation
3 = more than 50 percent but less than 75 percent defoliation
4 = more than 75 percent but less than 100 percent defoliation
5 = complete defoliation, only leaf midribs remaining.

An average of the 40 defoliation indices, two per sample stop on each side of each belt, was recorded for each shelterbelt. Defoliation indices were ranked numerically and a nonparametric statistic (H) was used to test for significant differences in defoliation among treatments.

## RESULTS

Defoliation in 1979 was significantly less in shelterbelts treated in 1978 than in untreated belts, but there were no truly significant differences among the three spray treatments. However, mean defoliation index was lowest and least variable among shelterbelts receiving the 3-gallon/acre treatment (table 1).

Defoliation was generally lower in 1979 than in 1978 (figure 1). Why this is so is unknown, but the extremely cold winter of 1978-79 could have caused some mortality of overwintering fall cankerworm eggs. Spring cankerworms spend the winter in the soil and lay eggs on host trees in the spring and should be less susceptible to extremely cold winter temperatures. Cankerworm populations were not monitored in 1979, so we do not know whether one or both cankerworm species were reduced in 1979 compared to 1978 populations. A noticeable amount of branch and whole tree mortality occurred in test shelterbelts between June of 1978 and 1979. Although not proven, speculation 2/ attributes this to a combination of cankerworm stressed trees and unusually adverse winter weather.

---

2/ Personal communication, Mary Ellen Dix, Rocky Mountain Forest and Range Experiment Station, Bottinneau, ND.

Table 1.--1979 plot mean defoliation indices converted to numerical rank and analyzed for significant differences 1/

| Treatment (volume per acre and time of application) | Plot number | Defoliation index | Rank (a) | Rank (b) |
|---|---|---|---|---|
| Check | 5 | 3.30 | 22 | -- |
| | 6 | 3.55 | 24 | -- |
| | 12 | 3.18 | 21 | -- |
| | 17 | 3.10 | 20 | -- |
| | 18 | 2.83 | 19 | -- |
| | 26 | 3.40 | 23 | -- |
| | | Mean+SE= 3.23±0.10 | Sum=129 | |
| 3 gallon day | 8 | 1.70 | 14 | 14 |
| | 9 | 1.03 | 3.5 | 3.5 |
| | 13 | 1.08 | 5 | 5 |
| | 19 | 1.03 | 3.5 | 3.5 |
| | 20 | 1.23 | 9 | 9 |
| | 29 | 1.15 | 8 | 8 |
| | | Mean+SE= 1.20±0.10 | Sum= 43 | Sum= 43 |
| 1 gallon day | 7 | 1.75 | 15 | 15 |
| | 10 | 2.03 | 16 | 16 |
| | 14 | 2.18 | 17 | 17 |
| | 21 | 1.28 | 10 | 10 |
| | 24 | 1.00 | 1.5 | 1.5 |
| | 28 | 1.00 | 1.5 | 1.5 |
| | | Mean+SE= 1.54±0.21 | Sum= 61 | Sum= 61 |
| 1 gallon night | 1 | 1.10 | 6 | 6 |
| | 3 | 1.68 | 13 | 13 |
| | 4 | 1.65 | 12 | 12 |
| | 15 | 1.15 | 7 | 7 |
| | 16 | 1.30 | 11 | 11 |
| | 27 | 2.58 | 18 | 18 |
| | | Mean+SE= 1.58±0.22 | Sum= 67 | Sum= 67 |

1/ Rank Comparison — Kruskal-Wallis Statistic

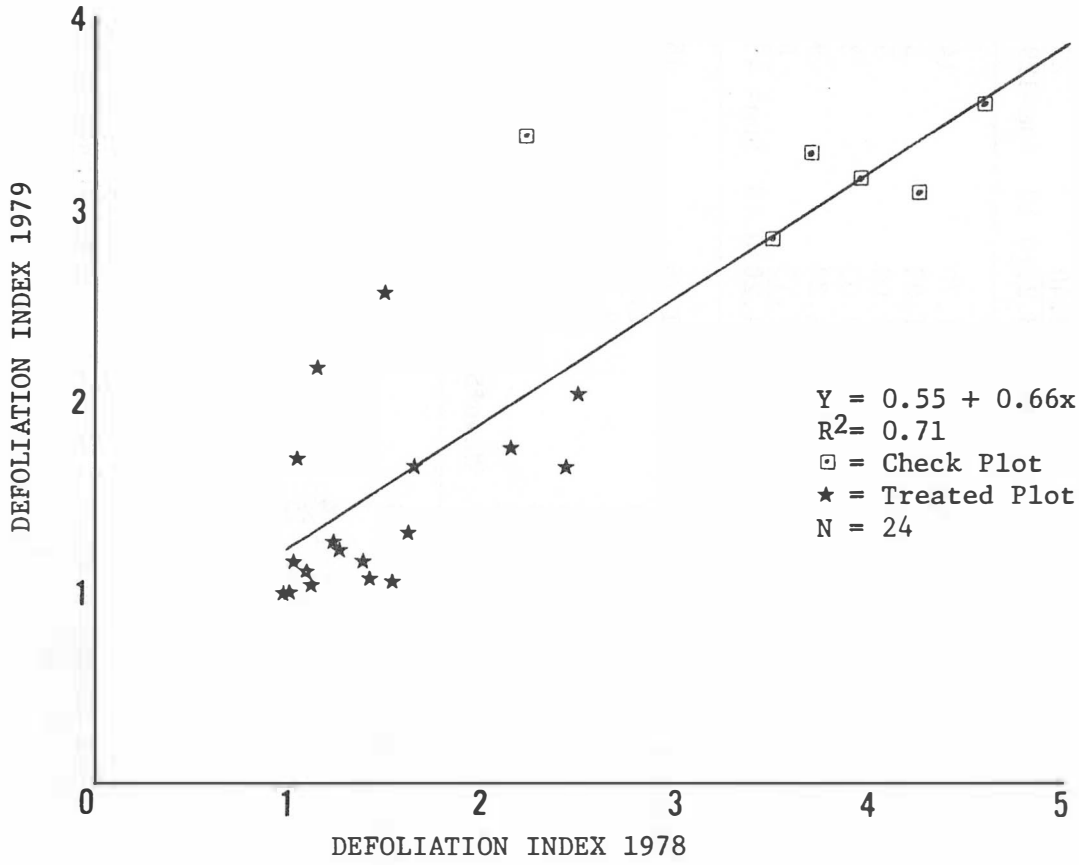
(a) checks and spray treatments — H= 14.00**

(b) spray treatments only — H= 1.82 n.s.

** = significantly different at the 1 percent level

n.s. = not significantly different

Figure 1. Defoliation in 1979 was closely related to but generally less than defoliation by cankerworms in 1978.



## CONCLUSIONS

1. Defoliation by cankerworms in 1979 was significantly less in 1978 treated shelterbelts than in untreated shelterbelts.

2. Most shelterbelts treated in 1978 retained enough foliage by late June 1979 so that adjacent crops were protected from wind.

3. Aerially applied Bt at a rate of 1/2 lb./acre provided shelterbelt foliage protection for 2 seasons.

4. The 3 gallon/acre Bt formulation appears to provide more consistent foliage protection than the 1 gallon/acre formulation.

## REFERENCES

Hard, J., R. Frye, D. Carey, and M. E. Dix. 1979. An evaluation of day and night aerial Bt applications for cankerworm control in Siberian elm shelterbelts. USDA-Forest Service, Northern Region, State and Private Forestry.